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THE ROLE OF PROGRAMS AND POLICIES IN SHAPING THE OBSERVED
SCHOOL NUTRITION ENVIRONMENT AND RURAL CHILDHOOD OBESITY

BY

SHADAI S. MARTIN

A dissertation submitted in partial fulfillment of the requirements for the

Doctor of Philosophy

Major in Nutrition and Exercise Science

South Dakota State University

2018

THE ROLE OF PROGRAMS AND POLICIES IN SHAPING THE OBSERVED
SCHOOL NUTRITION ENVIRONMENT AND RURAL CHILDHOOD OBESITY

SHADAI S. MARTIN

This dissertation is approved as a credible and independent investigation by a candidate for the Doctor of Philosophy in Nutrition & Exercise Science and is acceptable for meeting the dissertation requirements for meeting the dissertation requirements for this degree. Acceptance does not imply that the conclusions reached by the candidate are necessarily the conclusion of the major department.

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This dissertation is dedicated to my parents. Thank you for the many years of support, encouragement and guidance. Thank you for loving me more than I loved myself some days and helping me to realize that my life is worth it, and I do deserve good things in life. There were many days where all I could think about was packing up and going home but you would always know the right words to say to keep me going. Although it has been 1 year and 4 months since I have last seen you all, thank you for calling me every single day, sometimes a few times in a day to make sure I was still going and letting me know I was one day closer. Mom, I value your wisdom and I hope to be half the woman you are one day. I love you with all my heart; thank you for never giving up on me and loving me unconditionally. Our best is yet to come!

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ABBREVIATIONS

BMI-body mass index

HHFKA – Healthy Hungry- Free Kids Act

LEA – Local Education Agencies

NSLP- national school lunch program

RUC codes- Rural-Urban Continuum Codes

SPAN-ET – School Physical Activity and Nutrition Environment

SWP- school wellness policy

USDA- United States Department of Agriculture

Well SAT – Wellness School Assessment Tool

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ABSTRACT

THE ROLE OF PROGRAMS AND POLICIES IN SHAPING THE OBSERVED
SCHOOL NUTRITION ENVIRONMENT AND RURAL CHILDHOOD OBESITY

SHADAI MARTIN

2018

Childhood obesity is an ongoing public health concern that impacts many children in the United States. Research has shown that the prevalence of childhood obesity is higher in rural populations compared to non-rural populations. This may be attributable to differences in the school nutrition environment, particularly school meals and school wellness policy implementation. In order to design effective intervention targeted at weight management and obesity reduction, information regarding the school nutrition environment must be known. Therefore, the purpose of this research was to examine the school nutrition environment, particularly school lunch participation and weight outcomes between metro, non-metro and rural counties. Additionally, strength and comprehensiveness of nutrition wellness policies and its association with the nutrition environment along with nutrition policy implementation were examined. Rural populations are understudied and differ from their metro and non-metro counterparts in terms of sociodemographic factors and access to food.

The following analyses utilize school meals participation data from the Annie E. Carsey Foundation, SPAN-ET tool from the Oregon State University extension services and WellSAT tool from UCONN Rudd Center. School lunch participation by county ruralness was examined to determine if meal participation was associated with weight outcomes. Strength and comprehensiveness of school nutrition wellness policies and the

observed physical, situational and policy nutrition environment were examined and finally SPAN-ET and WellSAT scores were examined to assess whether more comprehensive and stronger policies equate to better nutrition policy implementation and a better nutrition environment. The findings in this dissertation can be used not only to understand how the school nutrition environment can play a role in weight management, particularly in rural neighborhoods but also for determining how to move forward for designing appropriate interventions targeted at reducing obesity in these populations.

Introduction

Today, approximately 1 in 5 school aged children (ages 6-19) are classified as obese.¹ Multiple factors such as environmental factors, eating and physical activity behaviors, metabolism and genetics contribute to childhood obesity.² Childhood obesity has immediate and long-term impact on physical, social and emotional health.³ It has been shown that obese children tend to miss more school days compared to their counterparts of normal weight due to factors such as isolation, bullying and illness. Rural areas experience higher rates of obesity and overweight; rural areas are 25% more likely to be overweight or obese than their peers in metropolitan areas and are also at increased risk for poverty as they face lower access to health care, lower levels of physical activity, poorer-quality food and limited options for transportation.⁴ There are multiple reasons as to why children become obese, but genetics, lack of physical activity, unhealthy eating patterns or a combination of these patterns seem to be the main cause.¹ A child's overall diet and physical activity levels play an important role in determining their weight and many children in today's society spend quite a bit of time being sedentary.² Childhood obesity has immediate and long term impacts on physical, social and emotional health.³ Children who are obese are more than likely to become obese adults which usually is also linked to the individual developing heart disease, type 2 diabetes and risk factors for heart disease. There is also a social stigma attached to being obese that can be just as detrimental as physical limitations. Low self-esteem, lack of self-confidence and bullying may all be issues that may lead to poor academic performance at school. Depression, discrimination and even emotional eating may be an issue for some children who are overweight/obese.³

Obesity is defined as having excess body fat, with a BMI above the 95th percentile for children and teens of the same age and sex whereas overweight is defined as a BMI at or above the 85th percentile and below the 95th percentile for children and teens of the same age and sex.¹ BMI is generally used to assess an individual's body weight as calculations only require height and weight and is generally inexpensive and easy for clinicians' and the general public.¹ Children dwelling in rural areas are 25% more likely to be overweight/obese than their counterparts in urban communities.⁴ Challenges such as geographical distances between their home and opportunities for physical activity can be a hindrance. Lower access to healthcare, poorer quality foods and limited options for transport all impact obesity rates of those dwelling in rural areas. Families in rural areas have a higher risk of food insecurity compared to their urban peers; rural food deserts are associated with both higher rates of poverty and higher rates of childhood obesity.⁶

Importance of the Nutrition Environment

School food environments can have a large impact on children's dietary intake. Students consume meals and snacks daily at school and designing school policies on the federal and local levels that support healthy eating via incorporating evidence based nutrition standards and limiting competitive foods can have an impact on childhood obesity.⁵ Changes in the environment where children spend their time, which includes school, home and community settings can play a significant role in assisting children maintaining a healthy weight by incorporate daily physical activity and making nutritious foods easily accessible and fewer foods and beverages high in solid fat and sugar not

easily accessible.² Nutrition policy can also impact food availability and food choices. Federal and state policies regarding the nutritional value of foods (breakfast, lunch and snacks) served at public schools should be designed to improve health. A comprehensive school-based approach which supports school nutrition and physical activity environment along with incorporating parents, care givers and community members is effective at preventing obesity.

There has been increased public awareness regarding the impact that food choices and dietary practices have on health. Schools can play a critical role in childhood obesity as children spend a large percentage of their day at school. Most US children attend school for 6 hours a day and consume as much as half their daily calories at school.⁷ Developing and implementing school-based programs that promote physical activity and healthy eating can make a big impact on childhood obesity. School-based obesity interventions hold promise, but to make a difference, schools need accurate data.⁷ It's important to have not only height & weight data but data regarding health-related behavior, school health programs & policies to be able to make the right choices about how to allocate resources to address childhood obesity based on what creates the biggest impact. Data collection surveys can be a valuable asset to combatting childhood obesity as these surveys produce an abundance of data on measures such as physical activity, fruit and vegetable consumption, content of school vending machines, and school's physical education requirements. The data collected can be used to make meaningful changes regarding physical activity & nutrition policies along with environmental

changes in an effort to help children and the schools make better choices or improve certain policies that impact the children in an effort to reduce obesity.

Nutrition policies such as how to reward students for good behavior or good work and class parties can potentially have an impact on obesity and is an important part of the nutrition environment. Often, using food as a reward or as a punishment can undermine healthy eating habits. Giving sweets, chips, soda as a reward can often lead to children overeating foods that are high in sugar, fat and empty calories and may also interfere with children's natural ability to regulate their eating.⁸ It also encourages children to eat when they are not hungry to reward themselves. Using food as a special treat or giving "off-limit" foods to reward good behavior may send mixed messages and may even cause children to start associating "unhealthy" foods with certain moods, such as reaching for a sweet treat when feeling accomplished/happy. Cavities and weight gain through offering rewards with little/no nutritional content but high in sugar and the enabling of emotional eating at a young age can be detrimental as a child grows. Many times, best intentions can be sabotaged when rewarding children with food; some children may become less interested in eating their vegetables and behavior can turn from good to bad as deception may be used to get a reward.

Importance of School Meals

The majority of children who attend school consume at least one meal at school. The National School Lunch Program & The National School Breakfast Program is another way in which children's fruit and vegetable consumption can be impacted along with lowering the rate of childhood obesity. The National School Lunch program (NSLP) is a federally assisted program operating in over 100,000 public and non-profit private schools and residential child care institutions.⁹ Any child at a participating school may purchase a meal through the NSLP, however, children from families with incomes below or at 130 percent of the poverty level are eligible for free or reduced meals. Those with incomes between 130 and 185 percent of the poverty level are eligible for reduced-price meals.¹¹ Children from families with incomes over 185 percent of poverty pay a full price, though their meals are still subsidized to some extent. Local school food authorities set their own prices for full-price (paid) meals, but must operate their meal services as non-profit programs.¹⁰

School lunches must meet meal pattern and nutrition standards based on the latest Dietary Guideline for Americans. The current meal pattern increases the availability of fruits, vegetables and whole grains on the school menu. Following the implementation of the new guidelines, fruit selection increased by 23%; average fruit consumption was unchanged, but because more students selected fruit, overall more fruit was consumed post-implementation. Consumption of vegetables per student increased by 16.2%. Entrée selection per student remained unchanged. The meal pattern's dietary specifications set specific calorie limits to ensure age-appropriate meals for grades K-5, 6-8, and 9-12; other meal enhancements include gradual reductions in the sodium content of the meals.¹⁰

While school lunches must meet federal meal requirements, decisions about what specific foods to serve and how they are prepared are made by local school food authorities.

Similar to the National School Lunch program, the U.S. Department of Agriculture reimburses schools for each breakfast they serve, with higher reimbursements for reduced and free meals. Participating schools must offer free or reduced-price breakfast to eligible students and meals must meet federal nutrition guidelines.¹¹ According to the Economic Research Service of the USDA children from low income households or with parents leaving for work in the morning used the program the most. Children with access to school breakfast were more likely to consume breakfast in the morning. Previous studies have shown that children who eat breakfast have improved standardized test scores, attendance and punctuality and decreased hyperactivity, depression & anxiety. School breakfast has the same eligibility criteria as school lunch, but fewer than half of the lunch participants eat breakfast.^{12,13,14,15}

Within recent years, subsidized school meals have generally tilted towards processed, high in fat, sugar and sodium.¹³ In response to these trends, congress passed the Healthy, Hunger-Free Kids Act of 2010 which required the USDA to update its standards to align with the Dietary Guidelines for America Presentation and marketing of these foods is also important and can have significant benefits. Strong school breakfast and lunch policies can make a positive difference in children's diet and is important in the effort to reduce childhood obesity.^{13,16}

Importance of School Wellness Policies

The Local School Wellness Policy requirement was established by the Child Nutrition and WIC Reauthorization Act of 2004 and further expounded upon by the Healthy, Hunger-Free Kids Act of 2010. It requires each local education agency participating in the School Meals Program to develop a local school wellness policy that promotes the health of students and addresses the growing problem of childhood obesity.¹⁷ The responsibility for developing a local school wellness policy is placed at the local level so that the unique needs of each school under the jurisdiction of the LEA can be addressed.^{17,18} The School Wellness Policies (SWP) is a written document that guides local education agencies (LEA) or district's offices to establish a school environment that promotes students' health and well-being and ability to learn. In 2014, USDA Food and Nutrition Services (FNS) proposed regulations to create a framework and guidelines for written policies established by LEA's.^{17,18}

SWP's should include specific goals such as: nutrition promotion, nutrition education, physical activity and other school-based activities that promote student wellness. SWP's should also include nutrition guidelines for all foods and beverages, policies for other foods and beverages and policies for food and beverage marketing. Annual progress reports, three-year assessments, updates to the wellness policy, public updates, monitoring/oversight are the proposed rules for local school implementation under the Hungry-Free Kids Act of 2010.^{17,18,19}

SWP's, particularly nutrition policies can impact how food is purchased and consumed. Nutrition is important for student success; children who are healthy and well-nourished are more likely to attend school and are more prepared and motivated to learn.^{20,21} The school nutrition environment should encourage all students to make healthy eating choices and be physically active throughout the school day.^{21,22} The school environment is one where students can learn the knowledge and skills needed to make healthy decisions; school leaders can create an environment that supports clear expectations for healthy behavior by faculty, staff and students.²⁰⁻²⁴

Importance of Researching Rural vs Non-Rural

There are differences between rural and non-rural populations which include sociodemographic factors such as education, income, access and availability of food and physical activity resources.^{25,26} The majority of research regarding school meals and school wellness policies and the nutrition environment has occurred in metropolitan areas. Rural areas experience higher rates of obesity and overweight than the nation as a whole, but many rural areas do not have the resources to address this health concern.^{4,24} Rural healthcare facilities are less likely to have dietitians or individuals with expertise in weight management; schools can play a role in encouraging healthy weight and address challenges children in rural schools may face.^{4,24}

Conclusion

It is important to examine the relationship between school meals and weight outcomes in rural counties in an effort to assess why children in rural neighborhoods

experience higher rates of overweight/obesity than their counterparts in rural neighborhoods. School wellness policies have the potential to promote student's wellness, prevent and reduce childhood obesity and assure the school meal nutrition guidelines meet the minimum federal school meal standards but they must be implemented for them have an impact on the school nutrition environment. This information would be valuable in creating a school nutrition environment that fosters weigh management/ weight loss, particularly in rural counties and creating an environment that fosters student wellness. Additional studies that incorporate school meal participation in schools in rural studies are needed to close the gap on rural/urban disparity in obesity-related research. Additional studies regarding school wellness policy implementation and its association with the nutrition environment are needed to understand whether wellness policies are effective in creating a healthy school environment and understanding facilitators and barriers that can possibly have an effect implementation.

Specific Aims

The following chapters enhance the limited body of literature surrounding school meal participation, particularly school lunch in rural counties and school wellness policies and the nutrition environment. Specifically, school lunch participation by county ruralness was examined to determine if meal participation was associated with weight outcomes. Additionally, the association between comprehensiveness and strength of written nutrition wellness policies and the observed nutrition environment (physical, situational and policy) in schools was examined. Finally, written nutrition wellness

policies and specific nutrition areas of interest observed within the school environment were examined to determine if stronger and more comprehensive written school wellness nutrition policy scores correlated to better scores for implementing a healthful nutrition environment within the school.

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Chapter 2

Title

The Association Between Free & Reduced School Lunch Participation Rates and Rural
Obesity

Abstract

Purpose: The aim was to examine school lunch participation by county ruralness and to determine if meal participation was associated with weight outcomes.

Methods: De-identified data from a Midwest state were obtained in electronic format from the State Department of Health. Height, weight, sex and age were used to calculate body mass index z-scores, which were then categorized into overweight/obese vs not overweight/obese. Free and reduced-price school lunch program participation from 2013-2014 by county was obtained from the Annie. E Casey foundation and further classified by Rural-Urban Continuum Codes (RUC) codes. ANOVA and multiple regression were used to compare differences in mean BMI categories among RUC codes.

Results: Overall, rural counties had significantly higher rates of participation in the free and reduced-price school lunch program (group 3 = 53%) compared to non-metro neighborhoods (group 2 = 36%) and metro neighborhoods (non-metro = 34%), all ($p < 0.001$). Rural counties had significantly greater odds of overweight and obesity compared to their non-metro and metro counterparts ($p < 0.001$); free and reduced school lunch participation was a significant predictor of overweight/obesity ($p < 0.001$). When both free and reduced lunch participation and RUC code group were included together in the model, both remained significant ($p < 0.001$)

Conclusion: Higher free and reduced participation and overweight/obesity in rural counties may be attributable to higher rates of poverty and food insecurity in rural areas along with the challenge rural children face in locating affordable food due to food

desserts. School lunch, should be a part of the systematic approach in combatting childhood obesity, particularly in rural neighborhoods.

Introduction

Most children who attend public and non-profit private schools (K-5, 6-8, and 9-12) consume at least one meal at school.¹ The NSLP is a federally-assisted program operating in over 100,000 public and non-profit private schools and residential child care institutions.¹ Any child at a participating school may purchase a meal through the NSLP, however, children from families with incomes \leq 130% of the poverty level are eligible for free meals. Families with incomes between 130 and 185% of the poverty level are eligible for reduced-price meals.¹ Approximately 68% of all lunches served are free or reduced-price.² Local school food authorities set their own prices for full-price (paid) meals, but must operate their meal services as non-profit programs; participating school districts and independent schools receive cash subsidies and United States Department of Agriculture (USDA) foods for each reimbursable meal they serve.¹ School lunches must meet meal pattern and nutrition standards based on the latest Dietary Guideline for Americans.

Although not implemented until 2012, in 2010, Congress passed the Healthy, Hunger-Free Kids Act (HHFKA) which required the USDA to align its standards for school meals to the Dietary Guidelines for Americans in response to subsidized school meals shifting towards higher fat, sugar and sodium content.³ In 2007-2010, 67% of children did not consume sufficient fruit to meet the daily recommendations and 93% of children did not consume enough vegetables. In 2013, the Center for Disease Control (CDC) reported that the amount of whole fruit children aged 2-18 consumed each day increased by 67% from 2003-2010 but consumption is still low. Although there has been improvement in fruit consumption, recommended intake for fruit and vegetables are not

being met. The current meal pattern increases the availability of fruits, vegetables and whole grains on the school menu.³ Following the implementation of the new guidelines which encourages the use of a salad bar that offers fruits and vegetables in alignment with the dietary guidelines, fruit selection increased by 23%, but average fruit consumption was unchanged and consumption of vegetables per student increased by 16.2%.^{1,2} Rural schools however fared worse than urban and suburban schools with regards to fruit and vegetable consumption in the NSLP, and also with perceived student complaints about the new meals and purchasing of meals and consumption of meals.⁴ Schools in small towns and rural neighborhoods also had fewer policies to support healthy school meals and environments particularly with regards to fruit and vegetable availability than do urban and suburban schools.⁵

There has been an increase in the number of students qualifying for free and reduced-price lunch.^{8,9} With regards to percent of households participating in the National School Lunch program the Casey Institute found that 22.4% of rural households participated in this program compared to 12% participation in suburban neighborhoods and 22.7% participation in the central city.¹⁰ Children living in rural areas experience higher rates of obesity and overweight than their peers residing in metropolitan areas.⁶ 16.5% of rural children are obese compared to 14.4% of urban children, and 35.5% of children in large rural neighborhoods and 38.2% of children in small rural neighborhoods aged 10-17 are overweight or obese compared to 30.1% of urban children.⁷

In general, little is known about school lunch participation in rural counties and even less regarding factors related to school lunch participation and weight outcomes in rural counties.¹¹ School lunch makes up one-third to one-half of a child's nutritional intake for an entire day and is essential for helping children succeed in school and develop successfully and healthfully.¹ It has been noted that under the old school guidelines students who eat school lunches are more likely to be overweight than their classmates with bag lunches; students just eligible for free and reduced-price lunch enter kindergarten with the same BMI as those who were not eligible but at the end of first grade they are significantly heavier.^{11,12} Under the old guidelines that students receiving free or reduced-price lunches are more likely to select entrees with more fat or less protein than students who purchase full-price lunches.¹³ However, there have been no research studies published regarding school meal participation in rural neighborhoods, particularly school lunch and weight outcomes.

The school food environment can assist with shaping children food preferences, food acceptance patterns and food choices. School lunch can provide nutritious food and assist children, particularly in rural neighborhoods, with meeting their daily nutritional needs.^{3,9,14} In this study, a mid-west's state 2013-2014 school lunch participation rates by county were matched to RUC codes and BMI percentiles to analyze participation rates in metro, non-metro and rural counties and also overweight/obesity. The aim was to examine school lunch participation by county ruralness and to determine if meal participation was associated with weight outcomes.

Methods

2013-2014 de-identified data from a Midwest state were obtained in electronic format from the State Department of Health. Height and weight were used to calculate body mass index (BMI) and further classify subjects into BMI categories. (Table 2.1). The county variable was used to assign a Rural Urban Continuum (RUC) code to each individual. RUC codes (rural-urban continuum codes) form a classification scheme that distinguishes metropolitan (metro) counties by their population size of their metro area and nonmetropolitan (nonmetro) counties by degree of urbanization and adjacency to a metro area or areas.¹⁵ For this study, RUC codes 8 and 9 were considered rural (RUC code group 3), Counties within RUC codes 5, 6 and 7 were considered non-metro (RUC code group 2) and counties within RUC code 3 were considered metro (RUC code group 1) (Table 2.2). RUC code 4 was not represented in this study as no county fit the definition of this code. Grouping by RUC codes in this study allowed for county data to be broken into finer residential groups beyond metro and non-metro.¹⁵

Free and reduced-price school lunch program participation data by county from 2013-2014 were obtained from the Annie. E Casey foundation.¹⁶ Each county's school lunch percent participation was attached to their respective RUC codes. Counties with missing percent participation rates in the lunch program during 2013-2014 were eliminated (one county); counties with no RUC code assigned were also eliminated (one county). Ultimately, 46,356 students were included in analyses.

Statistical Analyses

Data were analyzed in Stata Statistical Software: Release 15.¹⁷ One-way ANOVA with a Bonferroni post-hoc test was used to determine if free- and reduced-price lunch participation differed across RUC code groups. Chi-square analyses were used to examine differences in proportion of BMI categories (overweight/obese vs not) across RUC code groups. Logistic regression was used to examine the relationship between free- and reduced-price lunch participation, RUC code group and overweight/obesity (outcome) whilst controlling for race, age and gender.

Results

Rural counties (RUC code group 3) had significantly higher rates of participation in the free and reduced lunch program (53%) compared to non-metro counties (RUC code group 2, 36%) and metro counties (RUC code group 1, 34%), ($p < 0.001$), (Figure 2,1).

Group 2 had higher odds of obesity compared to group 1 ($p < 0.001$) and group 3 had higher odds of obesity compared to group 1 ($p < 0.001$)

When controlling for race, age and gender, RUC code group (i.e. rurality) was significantly associated with child overweight/obesity ($p < 0.001$). Likewise, free and reduced lunch participation was significantly associated with child overweight/obesity ($p < 0.001$). When both free and reduced lunch participation and RUC code group were included together in the model, both remained significant ($p < 0.001$). (Table 2.1)

Discussion

There has been an increase in the number of students qualifying for free and reduced-price lunch.^{8,9} Within the school meals program, rural schools however fared worse than urban and suburban schools with regards to fruit and vegetable consumption in the NSLP. At the same time, children living in rural areas experience higher rates of overweight and obesity than their peers residing in metropolitan areas. In general, little is known about school lunch participation in rural counties and even less regarding factors related to school lunch participation and weight outcomes in rural counties. In this study, we assessed whether rural counties had higher rates of participation in the free or reduced lunch program compared to their metro and non-metro counterparts and if free- and reduced-price school lunch participation was associated with overweight/obesity. Free and reduced lunch participation and overweight and obesity were higher in rural counties. Free and reduced lunch participation and RUC code groups were both significant contributors to child overweight/obesity.

Although previous work has not specifically examined free and reduced lunch participation in rural areas, rural areas typically have a lower population density and lower student enrollment rates compared to their metro and non-metro counterparts which could potentially play a role in higher percent participation in the free and reduced lunch program seen in rural counties in this study. Of the 46,356 students in this study, 4% (2067 students) were classified as rural, compared to 53% (24387 students) metro, 36% (16,834 students) non-metro. Schools where there are few nonsubsidized students participating in the NSLP meal program, participation itself may be an easily recognizable marker of income status and may deter those who qualify or may need free and reduced lunch from utilizing the school lunch program keeping the percent

participation low, which could potentially be the cause of lower free and reduced lunch participation percent in metro neighborhoods.¹⁸ Higher free and reduced lunch participation in rural counties may also be attributable to higher rates of poverty and food insecurity in rural areas along with the challenge of locating affordable food due to food deserts.⁹ Food deserts typically exist in rural areas for economic reasons such as low - income populations and insufficient population base to support a grocery store that stocks a variety of healthy and affordable foods, which may also be the reason why rural counties in this study had higher overweight and obesity.^{7,19,20} Other factors that may play a role in free and reduced-price lunch participation include school level and neighborhood circumstantial factors.²¹ Lower levels of stigma were found to be associated with increased likelihood of individual-level NSLP participation, whilst controlling for the local area poverty rate.²¹ Enrollment, outreach and practices that identify low-income students who have received subsidized meals under the NSLP, also have the potential to inhibit participation by stigmatizing program participants in some counties, although it is officially prohibited.²²

School lunch has the potential to impact childhood rural obesity; prioritizing fruits and vegetables, increasing funding for the farm to school grant program, smart snacks, and nutrition education can all have a positive impact on the school food environment and can help to shape lifelong healthy eating behaviors.^{21,22} Schools have the potential to assist students with making choices that are healthy via even subtle methods such as marketing fruits, vegetables and water via posters whether in the cafeteria or on vending machines that stock preferably foods and beverages that meet smart snack regulations, textbooks or even school scoreboards.^{23,24,25,26}

This study is not without limitations. RUC code 4 was not represented in this study as no county fit the definition of this code. Majority of schools visited in this study were located in rural counties. Having equal parts rural, metro and non-metro schools and being able to observe the scores would make this study more generalizable. These rural schools also had small school population sizes which may not be the case in more populated states with multiple inner-city schools. Despite these limitations this study is the first to assess school lunch participation by county ruralness and to determine if meal participation was associated with weight outcomes.

Conclusion

Many factors play a role in free and reduced-price lunch participation such as school level and neighborhood circumstantial factors. Higher free and reduced participation and overweight/obesity in rural counties may be attributable to higher rates of poverty and food insecurity in rural areas along with the challenge rural children face in locating affordable food due to food deserts. Rural children face unique challenges in locating affordable and healthy food; school lunch, should be a part of the systematic approach in combatting childhood obesity, particularly in rural neighborhoods.

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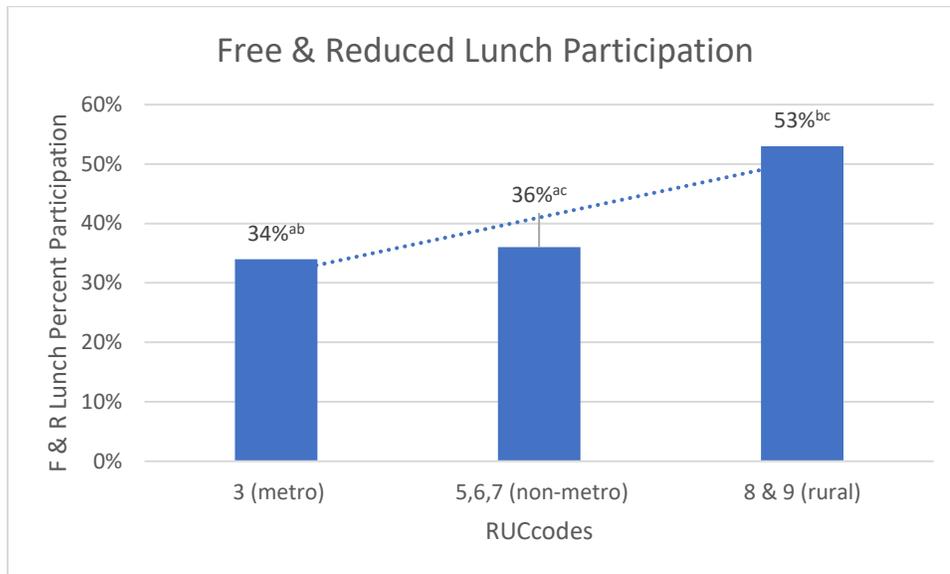
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Table 2.1- BMI Definitions ²⁷

| BMI categories | Definition |
|-----------------------|--|
| Category 1 | Underweight, less than the 5 th percentile |
| Category 2 | Healthy weight, 5 th percentile up to the 85 th percentile |
| Category 3 | Overweight, 85 th to less than the 95 th percentile |
| Category 4 | Obese, equal to or greater than the 95 th percentile |

Table 2.2. Rural-Urban Continuum Codes Definitions¹⁵

| Rural-Urban Continuum Codes (RUC codes) | Code Definitions | Number of counties in each RUC code |
|--|---|--|
| Metro (RUC code group 1) | | |
| RUC code 3 | Counties in metro areas of fewer than 250,000 population | N= 7 |
| Non-Metro (RUC code group 2) | | |
| RUC code 5 | Urban population of 20,000 or more, not adjacent to a metro area | N=3 |
| RUC code 6 | Urban population of 2,500 to 19,999, adjacent to a metro area | N=5 |
| RUC code 7 | Urban population of 2,500 to 19,999, not adjacent to a metro area | N=9 |
| Rural (RUC code group 3) | | |
| RUC code 8 | Completely rural or less than 2,500 urban population, adjacent to a metro area | N=8 |
| RUC code 9 | Completely rural or less than 2,500 urban population, not adjacent to a metro area | N=37 |

Figure 2.1: Summary of Free & Reduced Lunch Participation by RUC code group

*Similar superscripts indicate a significant difference between groups at $p < .001$

Table 2.3: Estimated associations between RUC code groups and overweight/obesity while controlling for race, age and sex.

| | Odds Ratio | Std. Error | P> z | 95% CI |
|--|------------|------------|-------|--------------|
| Free- and Reduced Lunch Participation | 1.57 | .18 | 0.000 | (1.25, 1.97) |
| RUC code group (1) | | | | |
| 2 | 1.14 | .03 | 0.000 | (1.10, 1.20) |
| 3 | 1.29 | .05 | 0.000 | (1.19, 1.39) |

Chapter 3

Title: The Association between Strength and Comprehensiveness of Written School Nutrition Wellness Policies and the Observed Nutrition Environment

Abstract

Purpose: To determine if written school wellness policies exist and examine whether there is an association between Strength and Comprehensiveness of written school nutrition wellness policies and the observed physical, situational and policy nutrition environment within elementary schools.

Methods: Twenty-six elementary schools were visited during the 2017-2018 academic year. At each school, the School Physical Activity and Nutrition Environment Tool (SPAN-ET) was used to assess the physical, situational and policy environment within the school. Two trained researchers scored independently; discrepancies in scores were discussed and the best possible answer chosen. School Wellness Policies (SWP) were scored by two trained researchers, using the WellSAT 2.0 tool prior to the onsite school visit.

Results: Every school assessed had a wellness policy. There were no statistically significant associations between the strength and comprehensiveness of written nutrition wellness policies and the observed physical, situational or policy nutrition environment within schools.

Conclusion: There is a disconnect between written wellness policies and the healthfulness of the school nutrition environment. Care must be taken to ensure that written wellness policies align with the observed nutrition environment which is important for ensuring strong and comprehensive policies in place that support evidence-based healthy nutrition environment.

Introduction

According to the Center for Public Education, children spend approximately 175 to 180 days at school and/or between 900 and 1,000 hours of instructional time per year depending on the grade level.¹ Adequate nutrition and physical activity are important for children's development and wellbeing and the school environment is a good place for students to learn and practice healthy habits.² The school environment can make it either easier or more difficult for children to choose nutritious food and acquire physical activity.^{2,3} Children can learn about nutrition through the curriculum, but school provides multiple opportunities to practice and reinforce healthy eating behaviors and acquire physical activity.⁴

An organization without policy is one void of control; formal documented policies allow for guidance on how to make decisions and an absence of policy leads to inconsistency with decision making.⁵ School wellness policies are important as they assist schools with establishing rules and procedures and create a standard of quality as well as accountability and expectations, but they must be implemented for them to be effective.^{5,6} Healthy policies have played a key role in school settings for quite a while; school wellness policies generally include a number of provisions designed to address childhood obesity and often include nutrition standards, nutrition education, physical education and health promotion programs.^{5,6} There are many additional benefits to having a well written school wellness policy which includes: efficient staff decisions, reduction in bias of decision-making and instructions on how to execute a task. School wellness policies also guide the food and beverages offered and sold at schools along with the amount of physical activity children should receive daily.^{5,6}

During the 2006-2007 school year, all districts were required to establish a local school wellness policy. In 2010, Congress passed the Healthy, Hunger-Free Kids Act of 2010 and added new provisions for local school wellness policies related to implementation, evaluation and publicly reporting on progress of local school wellness policies.⁶ Local education agencies were required to begin developing a revised school wellness policy during the 2016-2017 school year, with full compliance with all the requirements being adhered to by June of 2017.⁶ Local education agencies are supposed to evaluate their wellness policy once every three years which should be made available to the public.⁷ In addition to district wellness policies, some individual schools have developed their own guidelines around wellness.³ Studies have demonstrated that school wellness policies exist but the language of policies is vague with a wide variation in strength of the language used to address mandated components.^{8,9,10,11} Whilst comprehensiveness and strength of SWP's have been increased in the years following the 2006-2007 mandate by Congress, they remain highly inconsistent and weak. Prior to the federal mandate, fewer than half of all U.S school districts adopted policies to promote healthy eating and physical activity but after the mandate nearly all had adopted a policy of some sort, however, relatively little has been written about policy implementation and evaluation.¹²

The school nutrition environment can help shape lifelong healthy eating behaviors by providing students with nutritious appealing foods and beverages, consistent and accurate messages about good nutrition. Schools can implement policies and practices to create a nutrition environment that supports students in making healthy choices. School wellness policies are an important tool for parents, local educational agencies (LEAs) and

school districts in promoting student wellness, preventing and reducing childhood obesity, and providing assurance that school meal nutrition guidelines are met, but they must be implemented to be effective.^{5,6} Therefore, the aim of this proposed study is to determine if written school wellness policies exist and examine whether there is an association between Strength and Comprehensiveness of School Nutrition Wellness Policies and the Observed Physical, Situational and Policy Nutrition Environment.

Methods

School Recruitment

A list of school districts within a Midwest state was obtained from the department of education website. Every elementary school principal was contacted by the Department of Education via a recruitment e-mail. If interested, schools were encouraged to complete a recruitment questionnaire. As part of this electronic questionnaire, principals attached their current school wellness policy (SWP) and staff contact information. Twenty-six schools were visited during the fall of 2017 and spring of 2018.

Assessments

The School Physical Activity and Nutrition Environment Tool (SPAN-ET) was used to quantify the school's physical, situational and policy environment as it relates to nutrition and physical activity.¹⁴ Completing the SPAN-ET involved several methods of data collection including face-to-face and/or telephone interviews with key informants, on-site direct observations, and content review of various forms of documentation, including written and/or published district and school wellness policies, nutrition and

school meal policies and guidelines, school meals menus, playground rules and regulations. Two trained data collectors conducted SPAN-ET independently and simultaneously.

Upon completion of SPAN-ET, scores were calculated separately by 2 individuals, discrepancies were discussed, and the best possible answer chosen. Scores were grouped into poor (<25%), fair (26% <50%), good (51% <75%) and best (76% <100%) based on guidance from the scoring document. A report was generated targeting areas and strategies for improving the nutrition and/or physical activity environments to promote healthy habits and enhance student learning outcomes.

For this study, only nutrition environment sections of the SPAN-ET were examined. The physical nutrition environment included cafeteria/meal service area and garden features scores, while the situational nutrition environment included school meals, food and beverage habits, food and beverage practices, drinking water, cafeteria atmosphere and before/after school extracurricular programs and nutrition and wellness policy. Additionally, nutrition and wellness committee and health and nutrition education scores from the policy environment were used. The physical, situational and policy environment sections were also summed for a total nutrition environment score.

To quantify the strength and comprehensiveness of written SWP, each was separately evaluated by two researchers, using the WellSAT 2.0 tool prior to the onsite visit.¹³ Sections from the WellSAT used to examine written nutrition-focused policies included nutrition education (NE) (section 1), standards for USDA child nutrition programs, and school meals (SM) (section 2) and nutrition standards for competitive and other foods and beverages (NS) (section 3). Written wellness policy strength refers to

describes how strongly the content is stated while comprehensiveness scores reflect the extent to which the recommended content areas are covered in the policy.

Statistical Analysis

Data were analyzed using Stata Statistical Software: Release 15.¹⁵ Schools with any missing criteria were eliminated (one school), results from 25 schools were used in this analysis. Pairwise correlations were used to examine associations between WellSAT and SPAN-ET sections. One-way ANOVA was used to determine if mean scores for WellSAT sections differed across categorical scores of SPAN-ET sections. When significant differences were found, post-hoc examinations using Bonferroni tests were used to determine which groups differed from each other.

Results

Every school attended had a wellness policy that minimally met district standards. Mean WellSAT nutrition section strength and comprehensiveness scores across categorical scoring of the physical, situational and policy environments are presented in Tables 3.1, 3.2 and 3.3, respectively. Overall mean WellSAT strength and comprehensiveness scores across categorical scoring of overall nutrition environment is presented in Table 3.4. There were no statistically significant associations between nutrition sections or overall scores within the written SWPs and the observed nutrition environment.

Discussion

Whilst comprehensiveness and strength of SWP's have been increased in the years following the 2006-2007 mandate by Congress, they remain highly inconsistent and weak, however relatively little has been written about school wellness policy implementation and evaluation. In this study we assessed whether stronger and more comprehensive written school wellness policy nutrition section scores were correlated with higher nutrition physical, situational and policy environment section scores, and ultimately, an observed healthier school nutrition environment.

Overall, no associations were seen between the written wellness policy sections and the physical, situational and policy nutrition environment sections examined. There was also no association between total SWP scores and the total nutrition environment. In the physical nutrition environment, no school scored within poor category, but quite a few schools scored within the best category (80% mean score). The current USDA school meals guidelines may potentially have a role to play with the schools having good score in the physical nutrition environment. School meals are required to meet specific nutrition standards to operate the school meals program which must align with the latest nutrition guidelines for Americans.³

The best situational environment had the lowest strength score for SWP nutrition standard for competitive foods. Assessment of the situational environment within schools incorporated school stores, school carts and vending machine content. High scores in this area indicates that schools had no school stores, carts or competitive foods with vending machine content meeting smart snack regulation; many schools had no written policies specifically addressing nutrition competitive foods in the situational environment. Many

of the schools had no before/after school summer extracurricular programs and hence nothing in the wellness policy to address it. Food and beverage practices, specifically vending machines, classroom parties/treats and food rewards, in this section could also be improved in the physical and situational environment. Overall strength of the wellness policies was also quite low across the situational environment which indicates minimal policies regarding the situational environment.

In the policy environment, no school scored within the best category as written wellness policies generally contained ambiguous policies and addressed few practices which lead to low comprehensiveness and strength scores. In the policy environment, the nutrition wellness committee, particularly having a committee with broad representation such as students, teachers, parents, various school administrators and a well-defined implementation and evaluation plan of the policies along with a well written and concise policy could also be improved. Some schools had not reviewed their policies within the last 3 years and had no formal wellness committee or agenda for the committee. Written wellness policies in this study often did not reflect school-reported nutrition policies and practices but all schools visited had a wellness policy that minimally met district standards. It was noted that accountability was a big factor as to why wellness policies were not adhered to and also a key barrier to policy implementation in these studies as key informant's data showed ubiquitous shortfall with who was responsible for executing and reinforcing school health and wellness policies even though it had already been adopted by the district.^{7,9,17,18}

Funding and time constraints represent important obstacles to the successful adoption, implementation, and evaluation of school wellness policies that will require systemic change in order to address.¹⁹ Gaining the support of key stakeholders and having adequate tools to support those responsible for implementation and evaluation might be overcome through programmatic strategies and social marketing initiatives.^{20,21,22} Evaluating the development and implementation of a policy is critical in understanding its effectiveness and provides important information about the barriers to and facilitators of implementation and its intended effect on the observed nutrition environment.

This study has certain limitations that should be noted. Majority of schools visited in this study were located in rural counties. Having equal parts rural, metro and non-metro schools and being able to observe the scores would make this study more generalizable. These rural schools also had small school population sizes which may not be the case in more populated states with multiple inner-city schools. Schools were only observed for one full school day, observing for multiple days would allow for assessing whether policies were followed consistently. Despite these limitations, there are very few studies that address comprehensiveness and strength of SWP's and its association with the nutrition environment and this study serves to fill that gap.

It is essential to evaluate, and review implemented policies regularly as a policy review seeks and identifies relevant policies and practices that are shaping the current health status of the school community.^{20,21} Policies may be implemented through various actions, instruments, protocols or procedures but once implemented they should be

analyzed/ evaluated in an effort to observe its consequences whether they are intentional or unintentional.²⁰ Only then can appropriate moderations to implemented policies be made, if necessary, to formulate alternatives or policy modifications that work more efficiently for that particular school environment. Improving policies and policy implementation can increase operational efficiency and impact learning.^{20,21,22}

Conclusions

Every school visited had a wellness policy that minimally met district standards. There is a disconnect between written wellness policies and the healthfulness of the school nutrition environment. Care must be taken to ensure that written wellness policies align with the observed nutrition environment so that there are strong and comprehensive policies in place that support evidence-based healthy nutrition environment. Evaluating the development and implementation of the policies is important for understanding its effectiveness and provides important information about the barriers to and facilitators of implementation.

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Table 3.1. Mean (\pm SE) WellSAT nutrition section scores across SPAN-ET nutrition physical environment section scores.

| | Poor | Fair | Good | Best | p-value |
|------------------------------|------|------|----------------|------|---------|
| NS Strength | - | 0 | 20.7 \pm 5.5 | 82 | .61 |
| NS Comp | - | 18 | 40.6 \pm 7.5 | 91 | .55 |
| SM Strength | - | 14 | 26.2 \pm 5.0 | 36 | .96 |
| SM Comp | - | 21 | 40 \pm 5.4 | 43 | .98 |
| NE Strength | - | 0 | 37.1 \pm 7.5 | 43 | .28 |
| NE Comp | - | 57 | 81 \pm 5.9 | 100 | .22 |
| Overall Strength | - | 2 | 24.4 | 48 | .55 |
| Overall Comprehensiveness | - | 23 | 45.9 \pm 5.1 | 80 | .46 |

p-value determined using one-way ANOVA (Bonferroni post-hoc); within WellSAT

variables, similar superscripts indicate significant different ($p \leq 0.05$)

NS – nutrition standards for competitive foods and beverages

SM- school meals

NE – nutrition education

Table 3.2. Mean WellSAT nutrition section scores across SPAN-ET nutrition situational environment section scores.

| | Poor | Fair | Good | Best | p-value |
|------------------------------|------|------|----------|----------|---------|
| NS Strength | - | - | 31.2±7.6 | 13.9±3.4 | .07 |
| NS Comp | - | - | 48.8±9.0 | 33.9±6.3 | .22 |
| SM Strength | - | - | 23.6±5.7 | 30.1±4.7 | .39 |
| SM Comp | - | - | 37.9±6.4 | 44.8±5.8 | .44 |
| NE Strength | | | 34.3±9.8 | 38.5±8.3 | .75 |
| NE Comp | | | 75.8±8.3 | 80.2±8.3 | .71 |
| Overall Strength | | | 18.9±4.1 | 31±6.0 | .13 |
| Overall Comprehensiveness | | | 39.8±4.3 | 52.4±6.8 | .16 |

p-value determined using one-way ANOVA; within WellSAT variables, similar

superscripts indicate significant different ($p \leq 0.05$)

NS – nutrition standards for competitive foods and beverages

SM- school meals

NE – nutrition education

Table 3.3. Mean WellSAT nutrition section scores across SPAN-ET nutrition policy environment section scores.

| | Poor | Fair | Good | Best | p-value |
|------------------------------|------|----------|----------|------|---------|
| NS Strength | 36.0 | 27.8±8.0 | 16.4±3.7 | - | .48 |
| NS Comp | 45.0 | 45.6±9.4 | 37.2±6.9 | - | .80 |
| SM Strength | 29 | 28.4±5.5 | 25.4±5.4 | - | .93 |
| SM Comp | 43 | 43.6±6.4 | 39.6±6.0 | - | .88 |
| NE Strength | 43 | 36.2±8.9 | 36.6±9.9 | - | .98 |
| NE Comp | 86 | 80.2±8.8 | 74.7±8.2 | - | .88 |
| Overall Strength | 24 | 28.5±6.4 | 21.9±4.3 | - | .74 |
| Overall Comprehensiveness | 42 | 49.9±7.2 | 43.1±4.5 | | .76 |

p-value determined using one-way ANOVA; within WellSAT variables, similar

superscripts indicate significant different ($p \leq 0.05$)

NS – nutrition standards for competitive foods and beverages

SM- school meals

NE – nutrition education

Table 3.4. Mean WellSAT nutrition section scores across all SPAN-ET nutrition environment section scores.

| | Poor | Fair | Good | Best | p-value |
|------------------------------|------|------|-----------|-----------|---------|
| NS Strength | - | - | 24.8±5.5 | 16.3±3.8 | .57 |
| NS Comp | - | - | 42.8±6.7 | 39.0±11.0 | .83 |
| SM Strength | - | - | 28.5±4.1 | 19±6.4 | .40 |
| SM Comp | - | - | 42.0±4.9 | 40±6.7 | .92 |
| NE Strength | - | - | 37.1±7.1 | 33.7±4.7 | .86 |
| NE Comp | - | - | 81.0±12.7 | 77.9±6.5 | .86 |
| Overall Strength | - | - | 27.0±4.5 | 17.3±1.7 | .43 |
| Overall Comprehensiveness | - | - | 47.8±5.0 | 41±3.5 | .62 |

p-value determined using one-way ANOVA; within WellSAT variables, similar

superscripts indicate significant different ($p \leq 0.05$)

NS – nutrition standards for competitive foods and beverages

SM- school meals

NE – nutrition education

Chapter 4

Title: Association between written school nutrition wellness policies and observed nutrition areas of interest within the elementary school environment

Abstract

Purpose: The aim of this study is to assess whether strength and comprehensiveness of policies equate to a better nutrition environment.

Methods: Twenty-six elementary schools were visited during the 2017-2018 academic year. At each school, the School Physical Activity and Nutrition Environment Tool (SPAN-ET) was used to assess the physical, situational and policy environment within the school. Two trained researchers scored independently; discrepancies in scores were discussed and the best possible answer chosen. School Wellness Policies (SWP) were scored by two trained researchers, using the WellSAT 2.0 tool prior to the onsite school visit.

Results: There was a statistically significant correlation between strength of SWP written nutrition standards for competitive foods and beverages section and garden features area of interest ($p=.01$) and a significant negative correlation between comprehensiveness of written SWP nutrition education section in the wellness policy and school meals area of interest ($p=0.05$). No other significant correlations were seen.

Conclusion: Assessing whether strength and comprehensiveness of school wellness policy is associated with better nutrition environment provides information that has the potential to shape policy development, implementation and in turn, the school nutrition environment. Understanding how schools are creating and implementing school wellness policies is important in determining where additional resources or support is needed to support school-wide adoption of wellness policies and also improve the school nutrition environment.

Introduction

During the 2006-2007 school year, all districts were required to establish a local school wellness policy. In 2010, Congress passed the Healthy, Hunger-Free Kids Act of 2010 and added new provisions for local school wellness policies related to implementation, evaluation and publicly reporting on progress of local school wellness policies.¹ Local education agencies were required to begin developing a revised school wellness policy during the 2016-2017 school year, with full compliance with all the requirements being adhered to by June of 2017.¹ Local education agencies are supposed to evaluate their wellness policy once every three years which should be made available to the public.¹ Although local education agencies are required to create school wellness policies and meet the school meal nutrition requirements in order to receive federally subsidized reimbursements, little evaluation of the effect of these policies on students and student health has been conducted.^{2,3} Currently, there are existing evaluation tools that allow researchers, schools and school districts to analyze the strengths and comprehensiveness of school wellness policies but in general there has not been much research regarding measuring the implementation of policies at the school level.^{3,4} Some studies have assessed the relative strength of written school wellness policies, examining the extent to which the policies contained enforcement mechanisms, funding mechanisms, provision for evaluation, or guidelines for addressing the federal mandate but little has been documented about policy implementation and evaluation after adopting the wellness policy.^{4,5}

School wellness policies are important as they assist with reinforcing and elucidating expected standards and should define what is expected or unexpected in the

nutrition and physical activity environment.^{6 7} The policies adopted should be tailored to each specific school's need and not just generic.⁸ Policies should be concise and measurable to be able to determine if it is effective. School policies should be realistic, and the school should have the time, resources and personnel to implement the policies; policies should be made available to the entire school staff.

There is a link between poor nutrition, obesity and chronic disease in youth.⁹ There has been increasing attention geared towards the school being an ideal setting for promoting nutrition eating practices, but nutritious foods need to be available and having nutrition education as a key component of the curriculum should be a key component of the physical environment.^{10,11} The school nutrition environment can provide students the opportunity to learn about and practice healthy eating through available foods and beverages, nutrition education and messages about food in the cafeteria and throughout the school campus. A healthy school nutrition environment can make it easier for students to make healthy choices; assessing the school nutrition environment identifies opportunities for improvement and begin a planning process for making schools even healthier. Policies should support creating a healthy nutrition environment but it is unknown if they do. The aim of this study is to examine whether strength and comprehensiveness of school wellness nutrition policy scores correlate to a better nutrition environment in Midwestern elementary schools.

Methods

School Recruitment

A list of school districts within a Midwest state was obtained from the department of education website. Every elementary school principal was contacted by the Department of Education via a recruitment e-mail. If interested, schools were encouraged to complete a recruitment questionnaire. As part of this electronic questionnaire, principals attached their current school wellness policy (SWP) and staff contact information. Twenty-six schools were visited during the fall of 2017 and spring of 2018.

Assessment

Twenty-six schools were visited during the Fall of 2017 and Spring of 2018. At each school, The School Physical Activity and Nutrition Environment Tool (SPAN-ET) was used to assess the school nutrition and physical activity environment.¹³ Completing SPAN-ET involved several methods of data collection including face-to-face and/or telephone interviews with key informants, on-site direct observations, and content review of various forms of documentation, including written and/or published district and school wellness policies, nutrition and school meal policies and guidelines, school meals menus, playground rules and regulations. Two auditors conducted SPAN-ET independently. The nutrition physical, situational and policy environments were assessed; discrepancies were discussed, and the best possible answer chosen. With the completion of SPAN-ET, a report was generated targeting areas and strategies for improving the nutrition and/or physical activity environments to promote healthy habits and enhance student learning outcomes and sent to every school that participated.

This study focuses on the specific areas of interest under the physical, situation and policy environment. In this study, cafeteria/meal service area and garden features scores from the physical environment were used; school meals, food and beverage habits, food and beverage practices, drinking water, cafeteria atmosphere and before/after school extracurricular program from the situation environment scores from the situation environment were used and nutrition and wellness policy, nutrition and wellness committee and health and nutrition education scores from the policy environment was used. Scores were grouped into 4 categories; poor (<25%), fair (26% < 50%), good (51%<75%) and best (76% <100%).

Each SWP was separately evaluated by two researchers, using the WellSAT 2.0 tool prior to the onsite visit.¹² For Well SAT, only nutrition education (NE) (section 1), standards for USDA child nutrition programs, and school meals (SM) (section 2) and nutrition standards for competitive and other foods and beverages (NS) (section 3) were used.

Statistical Analysis

Data were analyzed using Stata Statistical Software: Release 15.¹⁴ Schools missing SPAN-ET data were excluded from analyses (n=1), and a total of 25 schools were used in this study. Mean scores for each area of interest within the SPAN-ET were calculated by taking the number of criteria met divided by the total number of criteria within the area of interest and multiplying by 100. This scaled scores between 0-100, the same range used for WellSAT scores. Pairwise correlations were used to determine if areas of interest within the observed nutrition environment sections of the SPAN-ET

were significantly associated with scores from the nutrition sections of the written wellness policy.

Results

Mean scores for each SPAN-ET area of interest are presented in Table 4.1 along with frequency of categorical scoring. Correlations between each SPAN-ET area of interest and each nutrition section of the written wellness policy are presented in Table 4.2. There was a significant, positive correlation between strength of SWP nutrition standards for competitive foods and beverages section and the garden features area of interest ($p=.01$). Additionally, there was a significant, negative correlation between comprehensiveness of written nutrition education section in the wellness policy and the school meals area of interest ($p=.05$). No other significant correlations between the observed nutrition environment and wellness policy scores were seen.

Discussion

In this study we assessed whether strength and comprehensiveness of written wellness policies are correlated with a better observed nutrition environment in elementary schools. School wellness policy strength and comprehensive scores were examined against eleven separate areas of interest in the observed nutrition environment. Two significant correlations were found in this study; there was a significant positive correlation between strength of written nutrition standards for competitive foods and beverages and garden features of interest. There was a significant negative correlation between comprehensive SWP nutrition education and the school meals area of interest.

No other significant correlations were observed between strength and comprehensiveness of the school wellness policies and the observed nutrition environment.

With regards to physical, situational and policy environment, schools are doing well in the cafeteria/meal service (96% scored within the best category), school meals (83% scored within the best category) and drinking water availability (100% scored within the best category), but there is room for improvement with gardens/garden features (96% scored within the poor category) , nutrition wellness committees (60% scored within the poor category) and nutrition education (20 % scored within the poor category and 40% scored within the fair category).

For school meals, majority of the scores fell within best category (96%) but had low wellness policy strength and comprehensive scores (correlation= -.16). The current school meals program could possibly have a role to play in these results. In the observed nutrition environment school meal scores included standards for reimbursable meals, which the USDA provides to all schools participating in the school meals program. Currently, school meals must meet the Dietary Guidelines for Americans with their fruit, vegetables, whole-grains and protein although the decisions about what specific foods to serve and how to prepare meals are made by the local school food authorities.¹⁵

Assessment of food and beverage habits and food and beverage practice criteria incorporated school stores or carts, vending machines, fundraisers, birthday parties, classroom reward parties and classroom treats/rewards. Higher scores in this area indicates that schools did not use food as a reward for good behavior or good grades and the contents of the vending machines met smart snack regulations. Majority of schools,

all but one school scored within the poor category for garden features; only one school visited had a garden; there is room for improvement with school garden implementation. School gardens with edible fruits and vegetables have the potential to teach students about their true source of food and teach them valuable gardening and agriculture concepts and skills that can be integrated into subjects such as health education, science and art and also improve the school nutrition environment.¹⁶

In the health and nutrition education criteria, nutrition education policies, health educator hired by the school district and minutes of annual health education were assessed. Poor scores indicated that schools did not meet the recommended 400 minutes of annual nutrition education time and had no health educator. Due to lack of funds and resources many schools had no nutrition educator hired by the school district. Physical education teachers often incorporated nutrition education into their classes or the school nurse or counsellor provided weekly or monthly nutrition topics or education. This finding is similar to that of Snelling et al. who noted that schools have been successful in incorporating nutrition topics or lessons, but more resources are needed for schools to achieve the needed minutes of health and physical education.⁴

Implemented written wellness policies in this study, often did not reflect school-reported nutrition policies and practices, this is evident by there being no significant relationship between overall strength and comprehensiveness of school wellness policies and SPAN-Et nutrition and wellness policy area of interest. This finding was similar to Budd et al. who found that: the quality of wellness policy implementation varies among schools in the United States, with challenges to implementation including lack of time or

coordination of the policy team, lack of monetary resources, lack of student acceptance, no consequences for non-compliance, lack of training, unsure about how to proceed, lack of leadership and insufficient food and beverage choices available from vendors and suppliers.¹⁸ Understanding how schools are complying with school wellness policies is important in determining where additional resources or support is needed in order to support school-wide adoption of wellness policies and ensuring best practices for a healthy nutrition environment.¹⁹ Facilitating factors such as grants and barriers such as lack of clarity about responsibility for policy enforcement are important factors that determine whether policy implementation will be successful.²⁰ Funding and time constraints represent important obstacles to the successful adoption, implementation, and evaluation of school wellness policies that will require systemic change in order to address.²¹ Gaining the support of key stakeholders is also critical for successful policy implementation.²¹

This study is not without limitations. Majority of schools visited in this study were located in rural counties. Having equal parts rural, metro and non-metro schools and being able to observe the scores would make this study more generalizable. These rural schools also had small school population sizes which may not be the case in more populated states with multiple inner-city schools. Schools were observed for one full school day, observing for multiple days would allow for assessing whether policies were followed consistently and reflected the physical, situational and policy nutrition environment. Despite these limitations, there are very few studies that address comprehensiveness and strength of policy implementation and its association with the

nutrition environment; this study serves to fill the gap of whether strength and comprehensive nutrition policies have an impact on nutrition environment.

Conclusion

Assessing whether strength and comprehensiveness of school wellness policy is associated with better nutrition environment provides information that has the potential to shape policy development and the school nutrition environment. Lack of funds, resources and time constraint could potentially play a role in policy development and implementation and in turn the nutrition environment. Understanding how schools are creating and implementing school wellness policies is important in determining where additional resources or support is needed in order to support school-wide adoption of wellness policies and also improve the school nutrition environment, along with ensuring policies align with what we know about healthy eating nutrition environment within schools.

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Table 4.1. Mean criteria met for each area of interest and frequency of categorical scoring among all schools within the Physical, Situational and Policy Environment sections of SPAN-ET (n=25).

| Area of Interest (total criteria) | Mean (range) | Poor | Fair | Good | Best |
|--|--------------------|------|------|------|------|
| Cafeteria/Meal Service (5) | 93.9 (60-100) | - | - | 4% | 96% |
| Garden Features (2) | 2 (0-50) | 96% | 4% | - | - |
| School Meals (9) | 82.1 (66.7-100) | - | - | 17% | 83% |
| Food and Beverage Habits (7) | 47 (28.6-71.4) | 4% | 60% | 36% | - |
| Food and Beverage Practice (5) | 53.6 (20-100) | 16% | 32% | 28% | 24% |
| Drinking Water (8) | 98 (87.5-100) | | - | | 100% |
| Cafeteria Atmosphere (10) | 90 (70-100) | - | - | 4% | 96% |
| Before/After School Extracurricular Programs (7) | 53.7 (0-85.7) | 20% | 24% | 36% | 20% |
| Nutrition and Wellness Policy (15) | 55.5 (40-73.3) | - | 32% | 68% | - |
| Nutrition and Wellness Committee (5) | 36.5 (0-100) | 60% | 4% | 16% | 20% |
| Health and Nutrition Education (8) | 52 (12.5-100) | 20% | 40% | 24% | 16% |

Table 4.2. Correlation between SPAN-ET nutrition area of interest and WellSAT section score.

| Area of Interest (total criteria) | NS Strength | NS Comp | SM Strength | SM Comp | NE Strength | NE Comp | Overall Strength | Overall Comp |
|--|-------------|---------|----------------|---------|-------------|---------|---------------------|-----------------|
| Cafeteria/Meal Service (5) | .11 | .13 | -.01 | .01 | .23 | .27 | .13 | .16 |
| Garden Features (2) | .55** | .38 | .11 | .01 | .05 | .17 | .26 | .34 |
| School Meals (9) | -.35 | -.27 | -.15 | -.21 | -.34 | -.53* | -.38 | -.38 |
| Food and Beverage Habits (7) | -.15 | -.16 | -.12 | -.07 | -.34 | -.17 | -.29 | -.22 |
| Food and Beverage Practice (5) | .05 | .02 | -.11 | .09 | .14 | .11 | .003 | .07 |
| Drinking Water (8) | .03 | -.12 | -.13 | -.27 | -.10 | -.003 | -.11 | -.11 |
| Cafeteria Atmosphere (10) | .09 | .07 | -.01 | .13 | .13 | .11 | .05 | .14 |
| Before/After School Extracurricular Programs (7) | -.32 | -.12 | -.18 | -.20 | -.21 | -.25 | -.30 | -.27 |
| Nutrition and Wellness Policy (15) | -.22 | -.28 | -.23 | -.32 | .16 | .09 | -.16 | -.14 |
| Nutrition and Wellness Committee (5) | .05 | -.02 | .05 | .12 | -.13 | -.13 | .04 | .07 |
| Health and Nutrition Education (8) | -.30 | -.24 | -.15 | -.03 | -.25 | -.08 | -.26 | -.19 |

*P<0.05, ** P<0.01, ***P<0.001

Chapter 5- Discussion and Overall Conclusions

The purpose of this research was to examine school lunch participation by county ruralness and weight outcomes, along with the association between comprehensiveness and strength of wellness policies and the observed nutrition environment were examined and school wellness policy nutrition scores and nutrition policy implementation. It is known that childhood obesity is a prominent public health issue and previous research indicates that children in rural neighborhoods have higher prevalence of obesity compared to non-rural populations. This disparity may be driven by the school nutrition environment, however little research exists that investigate factors that have an effect on obesity, particularly in rural populations. General recommendations have been developed regarding guidelines on school meals components and school wellness policies development and implementation but not specific to the challenges rural populations may face. This dissertation adds to our understanding of school meal participation in rural neighborhoods and weight outcomes and how school wellness policies association with the observed nutrition environment. This information has the potential to be used for appropriate weight management intervention planning in the school nutrition environment.

The second chapter of this dissertation is the first study regarding school meals, particularly school lunch and weight outcomes in rural neighborhoods. There are a few studies that assess school meal participation in metropolitan areas regarding school lunch standards and the importance of school meals, and school meals and weight outcomes, however no other studies have assessed school meals and weight outcomes in rural

counties. The findings in this study provide important information on areas where school meals intervention aimed at weight loss can be successful in rural neighborhoods.

The third chapter of this dissertation builds upon previous cross-sectional research regarding whether school wellness policies exist and whether the nutrition environment, particularly the physical, situational and policy environment reflect school wellness policies. The findings in this study provide important information on barriers and facilitators regarding school wellness policy implementation. School wellness policies are an important tool for parents, local educational agencies (LEAs) and school districts in promoting student wellness, preventing and reducing childhood obesity, and providing assurance that school meal nutrition guidelines meet the minimum federal school meal but they must be implemented to be effective.

The fourth chapter of this dissertation builds upon previous research regarding school wellness policies and the observed nutrition environment. Very few research studies exist regarding strength and comprehensiveness of school wellness policy and the observed nutrition environment. This study provides important insight regarding whether strength and comprehensive policies correlate to a better observed nutrition environment. The findings in this study assist with determining where additional resources or support is needed to support school-wide implementation of wellness policies and also improve the school nutrition environment.

In conclusion this dissertation advances the knowledge of school meals, nutrition wellness policies and the observed nutrition environment. The first study was unique in that it was the first to assess school meals and weight outcomes in rural counties but at the same time incorporated counties from metro and non-metro areas. Study two and

three were unique in that they provide valuable information regarding barriers and facilitators to creating comprehensive and strong school wellness policies and whether school wellness policies have an effect on the nutrition environment. All of the data presented can not only be used for understanding factors that contribute to a healthy school nutrition environment but also for determining how to move forward with designing appropriate interventions targeting a health school nutrition environment and overall reducing childhood obesity.